



	Page
Concrete	234
Slump (234), Air entrainment (234), Accelerators (234), Retarders (235), Plasticizers (235), Superplasticizers (235).	
Heat flow and insulation	235
Measuring heat flow (236), Home insulating materials (237).	
Lumber grades	237
Dimension lumber grades (237), Moisture content (238).	
Design values for visually graded structural lumber	238
Plywood markings	238
Grade (239), Span ratings (239), Thickness (239), Species group number (239), Exposure durability (239), Mill number (240), Product standard (241).	
Finishing pressure-treated wood	241
Nailing schedules	241
Square corners	241
Converting dimensions in feet and inches to decimal form (243), Converting dimensions in decimal form to feet and inches (243), Example of squaring a foundation layout (243).	

Technical Notes

Concrete

Concrete consists of a mixture of Portland cement, sand, gravel, and various admixtures, combined in various proportions to meet specific conditions or requirements.

The most convenient way to obtain concrete is to order it from a local ready-mixed-concrete supplier. The ingredients for ready-mixed concrete are accurately measured, often in automated plants with computer equipment, and then mixed either at the plant or in a truck mixer, and delivered to the job site.

Producers of ready-mixed concrete can generally assist in the selection of appropriate mixes or in developing mixes to fulfill a builder's specific needs. Local practices in regard to ordering ready-mixed concrete vary, but usually ordering is either by performance or by prescription.

When concrete is ordered by performance, the builder specifies the strength level desired and the ready-mixed-concrete producer is responsible for proportioning and delivering a mixture that will yield the desired strength in a substantial majority of tests. For strength specifications to be meaningful, properly conducted strength tests are required.

When concrete is ordered by prescription, the builder specifies the weight of Portland cement per cubic yard, maximum amount of mixing water, admixtures required, and possibly their dosage rates. In essence, the builder accepts responsibility for the level of quality and performance.

Slump

Slump is a measure of the consistency or stiffness of fresh concrete expressed in inches. It is influenced by the amount of water—more water means more slump—but water is not the only factor. The type of aggregate, the air content, and the proportions of the ingredients all affect slump.

The slump test is a method of measuring the workability of concrete when wet, and also a check of the concrete's consistency from batch to batch. The test consists of filling a cylindrical mold of standard diameter and height with concrete, removing the mold, and measuring the distance the concrete settles after a given period of time. For residential work, slumps range from 4 to 7 inches.

Air entrainment

Air entrainment is essential for protecting concrete that is exposed to freezing, thawing, and the action of salts used for removing ice.

An air-entraining admixture or air-entraining cement causes microscopic air bubbles to form throughout the concrete, which acts as "relief" valves when the concrete freezes, helping to prevent scaling or spalling of the surface. (Scaling is a general crumbling of the surface cement layer of the concrete. Spalling is a form of chipping in which disc-like pieces loosen and pop out from the surface.) Resistance to deicers, which also cause scaling and spalling, is greater if the air-entrained concrete is dried for about 4 weeks after curing.

Air-entrained concrete is more watertight, more resistant to sulfate soils, and easier to work, particularly if the mixture is lean or has angular aggregates. Concrete strength is reduced somewhat by air entrainment, but a lower water/cement ratio is possible in an air-entrained mix and this can make up for any strength lost because of air entrainment.

Accelerators

Accelerators speed up the setting time and strength development of concrete and are especially useful in cold weather. They can be combined with water-reducing admixtures.

Calcium chloride is the most commonly used accelerator. It is not an antifreeze, but it speeds up the set and makes freezing damage less likely, especially if the concrete is protected from low temperatures while it is curing.

Because calcium chloride must be carefully used and may increase shrinkage on drying, alternative solutions should be considered.

- There are five types of Portland cement, designated types I through V. They vary in their characteristics, including rate of strength gain. It is conventional practice to use type I in concrete mixes. If type II is specified, the resulting mix gains strength twice as quickly on the first day that the mixture is placed. However, the strengths of mixtures using type I and type II are approximately equal after 3 months.
- Reducing the amount of water relative to the amount of Portland cement can accelerate the rate of

strength gain. Too much cement, however, can increase susceptibility to cracking. Altering of the water/cement ratio should therefore be done by an experienced professional.

- Higher temperatures during curing speed up strength gain considerably.
- Warming the mix by using heated water can accelerate strength gain.

Retarders

Retarders are chemicals that can be added to the concrete mixture in hot weather when the concrete may set so quickly that it cannot be finished properly. Retarders are also useful when difficult placements require more time. Some retarders are water reducers or plasticizers. Called water-reducing retarders, they slow down the set while speeding up placement by plasticizing the concrete. Not all plasticizers retard the set.

In hot weather, concrete sets more slowly when the aggregate or water, or both, are cooled. One effective method is to use chipped ice for part of the mixing water.

Plasticizers

Plasticizers make the concrete more workable with less water. Strength is increased by the low water/cement ratio, and labor costs are reduced because the concrete is more workable.

Some water reducers may increase shrinkage on drying, and this may increase cracking. Other water reducers, however, reduce shrinkage cracks, according to the manufacturers.

Water reducers may be either accelerators or retarders. The type chosen should fit the circumstance. For example, an accelerating water reducer is suitable for cold weather; a retarding water reducer is suitable for hot weather.

Some water reducers also entrain air. One should allow for the extent of this entrainment when specifying amounts of air-entraining agent.

Water reducers are worth investigating if the concrete needs added strength without increasing labor costs.

Superplasticizers

An ordinary water reducer can reduce water requirement by 10 to 15 percent while slightly increasing slump. A superplasticizer can increase slump dramatically from an original 3 inches to 7 or 8 inches. Because concrete mixtures with superplasticizers are much easier to place, labor costs can be reduced.

A superplasticized concrete mix is easier to work because of the almost liquid slump, and because of the consistency of the concrete. Cement masons liken it to a temporary lubrication of the mix. It can be chuted more easily at a lower angle and is almost self-leveling.

Heat Flow and Insulation

There are three primary mechanisms of heat transfer in building systems: conduction, convection, and radiation. By these mechanisms, heat flows from objects at higher temperatures to those at lower temperatures, that is, from hot to cold.

A common example of conduction is the metal handle on a frying pan. As the pan is heated, the handle becomes hot exclusively by the process of conduction. With most materials, the more dense the material, the higher its rate of heat flow by conduction. Metals transfer a great deal of heat this way, and so they are commonly used in electric transmission systems. Because they are excellent conductors, energy loss is at a minimum. Conversely, metal elements that extend through building sections are undesirable because of their high level of conduction.

In building material such as metal windows, heat flow by conduction can be reduced by use of a “thermal break.” A casing of metal encloses a core of a material, such as wood, that has low thermal conductivity, and the casing itself is not continuous from the inside to the outside. The separation of the casing provides the thermal break.

Heat flow by convection can be observed in a house in that second-story rooms are warmer than first-story rooms. This difference in temperature occurs because heated air is less dense than cooler air. The heated air moves up to and across the ceilings of the first-story rooms and up the stairway to the second-story rooms. At the same time, the cooler air, which is more dense, settles to the floors of the upper-story rooms, and moves across the floors and down the stairway to the first-story rooms.

The warmth of the sun on the skin illustrates heat flow by radiation.

An old-fashioned steam or hot water radiator transfers heat by radiation, conduction, and convection simultaneously. The cast-iron structure conducts heat to the outside surface of the radiator. Air flowing between and around the radiator transfers heat by convection. At the same time, the warm surface of the radiator face transfers (radiates) additional heat and thus warms any nearby surface at a lower temperature, including surfaces of people, furnishings, and interior walls of the room.

Measuring heat flow

Extensive measurements have been made of the heat flow characteristics of most building materials as well as entire building sections. Rating heat flow performance involves five forms of measurement—British thermal units (Btu's), thermal conductivity (k-value), conductance (C-value), thermal resistance (R-value), and the combined ability of a building section to retard heat flow (U-value).

British thermal unit. A Btu is defined as the amount of heat required to raise the temperature of 1 pound of water 1 °F. A Btu can be visualized as the amount of heat released by the burning of one wooden kitchen match from end to end. As a point of reference, a gallon of water weighs 8.33 pounds. Therefore, for example, it would take about 330 Btu's to raise the temperature of water 1 °F in a 40-gallon hot water heater. British thermal unit per hour (Btu/h) signifies the number of Btu's used per hour for a specified purpose.

Thermal conductivity. This measure, referred to as the k-value, introduces elements of size and time and may be applied only to homogeneous materials. The thermal conductivity of a given material is defined as the amount of heat that passes through a sample of the material 1 inch thick and 1 ft² in area, in 1 hour, with 1 °F difference in temperature between its two surfaces. The lower the k-value, the higher the insulating value. Insulation materials have k-values of 0.5 Btu/ft²/h/°F or less at temperatures normally encountered in building sections. Industrial insulations may have k-values of 1.0 or greater at the higher temperatures for which they are intended and used. The thermal conductivity of a material usually increases with mean temperature.

Conductance. The C-value is similar to conductivity but is a more flexible measurement unit. The thickness of the material is not confined to 1 inch. For example, a brick about 4 inches thick and nonhomogeneous materials such as concrete block can also be measured for C-values.

If the material is homogeneous, it is possible to determine the C-value if the k-value is known, and vice versa, using the relationship:

$$C\text{-value} \times \text{thickness} = k\text{-value}$$

For example, a homogeneous material with a C-value of 0.1 and a thickness of 3 inches has a corresponding k-value of 0.3. The lower the C-value, the higher the insulating value.

Thermal resistance. The R-value is a measurement of the ability of materials to retard heat flow rather than to transmit heat. Mathematically, R is the inverse of C or k. For example, a material with a C-value of 0.2 (1/5) has an R-value of 5.0.

The use of R-values makes it possible to add the thermal values of a whole series of materials. R-values have been measured for solid materials, nonhomogeneous materials, air spaces, and air films on both the inside and outside of building sections. Since R-values indicate the ability to retard heat flow, the higher the R-value, the higher the insulating value. Materials having the same R-value, regardless of thickness, weight, or appearance, are equal in insulating value. One should therefore specify insulation products by R-value rather than simply by thickness.

Table 21 lists R-values for some commonly available insulation materials.

The U-value. The sum of the conductances of all parts of a building section, including air films and air spaces adjacent to or a part of the building section, is called the U-value. Mathematically, it is defined as the number of Btu passing through 1 ft² of the combined building section in 1 hour for each degree Fahrenheit of temperature difference. The lower the U-value, the higher the insulating value. If an uninsulated frame wall has a U-value of about 0.25, a comparable insulated wall has reduced U-value of about 0.07.

Table 21—R-values for commonly available insulation materials

Material	Approximate R-value
Insulation, mineral wool blanket and batt	
Approximately 3 to 3½ inches thick	11.00
Approximately 5¼ to 6½ inches thick	19.00
Approximately 6 to 7 inches thick	22.00
Approximately 8½ to 9 inches thick	30.00
Approximately 12 inches thick	38.00
Insulation, board	
Glass fiber, organic bonded, 1 inch	4.00
Expanded polystyrene, extruded, cut cell, 1 inch	4.00
Expanded polystyrene, extruded, smooth, 1 inch	5.00
Expanded polystyrene, molded beads, 1 inch	3.57
Expanded polyurethane, 1 inch or more	6.25
Polyisocyanurate, 1 inch	7.20
Mineral fiber with resin binder, per inch	3.45
Insulation, blown loose fill	
Cellulosic, per inch	3.13–3.70
Perlite expanded, per inch	2.70
Mineral fiber (rock, slag, glass)	
3¾ to 5 inches	11.00
6½ to 8¾ inches	19.00
7½ to 10 inches	22.00
10¼ to 13¾ inches	30.00
13 to 17¼ inches	38.00
Vermiculite exfoliated, per inch	2.13–2.27

Home insulating materials

Home insulating materials retard the flow of heat from the inside to the outside in the winter, and from the outside to the inside in the summer.

The most widely used home insulation material is called fiberglass or rock wool. It is composed of fine inorganic fibers made from rock, slag, or sand, with other material added to enhance service properties. Available forms include: flexible batts and blankets, with and without facings; semirigid and rigid boards, with and without facings; and a loose form for blowing or pouring.

Batt and blanket insulation often has a facing of kraft vapor-barrier paper with stapling flanges. Sometimes an enclosure of “breather” paper (paper that does not stop moisture movement) is used on the outer face for rock wool materials. Batts and blankets are also available with aluminum foil facings, and stapling flanges, and in an unfaced form held in place by pressure.

Blown mineral wool must be installed with pneumatic equipment and requires the service of an insulation contractor. Like faced or unfaced batts or blankets, pouring wool can be used by homeowners to increase the performance level of attic insulation.

Mineral wool board insulation can be used on the inside face of crawl-space walls and the outside of basement walls. Mineral wool blankets and boards are available for duct insulation; building blankets should not be used for this purpose. Preformed mineral wool pipe insulation is also available through industrial insulation contractors for both hot and cold water piping.

Other types of insulation used in residential construction include:

- Foamed plastic insulation boards or sheets, which are used as exterior wall sheathing, foundation insulation, and perimeter edge insulation for slab-on-grade construction.
- Cellulose fiber insulation, which is used primarily in ceilings and in walls of existing homes. It should be pneumatically installed by an insulation contractor.
- Multiple-layer aluminum foil insulation, which is sometimes used between furring strips on masonry wall construction. It is fragile and must be installed with great care if it is to be effective.

Combustible vapor-retarding facings on insulation should not be left exposed. They should be covered with materials having an acceptable flame spread or fire rating. Breather paper is combustible and, when exposed in accessible space, should be either covered or stripped off after the batts are in place.

Lumber Grades

Softwood lumber is divided into three size categories. Finish grades nominally 1 inch thick and thicker are called *boards*. Pieces with nominal thickness ranging from 2 to 4 inches are called *dimension lumber*. Lumber 5 inches and thicker is called *timber*. Most framing materials used in light-frame construction are dimension lumber.

Dimension lumber is sold by grade, species (or species group), and size. Consider all grades and species suitable for the application and choose those that best meet the need. For economy in construction, it is recommended that the lowest grade suited to a job be used. Douglas-fir, hem-fir, or southern pine are good choices for longer spans because they are the stronger species, while other species may be more economical for shorter spans.

Lumber sizes in the United States are given as *nominal* dimensions (e.g., 2 by 4) in inches. At the time a piece of lumber is first sawn from a log it may approach those dimensions. Resawing, surfacing, and seasoning diminish the size considerably, resulting in an actual dimension that is less than nominal.

Dimension lumber is manufactured in lengths in 2-foot increments. The most common sizes are 8, 10, 12, 14, and 16 feet, but most lumberyards stock longer lengths. Actual lengths are usually slightly longer than nominal to allow for trimming. Most framing lumber is surfaced on four sides (S4S) and has eased edges (EE), although some square-edge stock is manufactured.

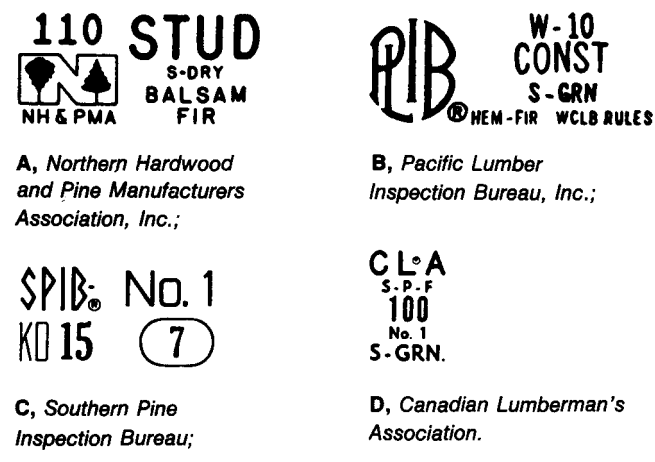
To assign lumber grades, a certified grader evaluates both natural and manufacturing characteristics. Unlike carpentry materials, framing lumber is graded primarily for strength rather than appearance. Lumber grading sets quality control standards among lumber mills manufacturing the same or similar products. An official grade stamp on a piece of lumber certifies its assigned grade.

All major building codes require that lumber used structurally be grade-stamped by an agency certified by the Board of Review of the American Lumber Standards Committee. The lumber standard requires that all grade stamps contain five basic elements: The symbol or lumber logo of the quality control agency; the mill number or name; the grade of the material; the species or species combination; the condition of seasoning at the time of manufacture. (Four examples are shown in figure 198.)

Dimension lumber grades

Dimension lumber grades are standardized throughout North America, regardless of species or grading agency. Under the National Grade Rule for Dimension Lumber

Figure 198—Examples of symbols or lumber logos of quality control agencies:



promulgated by the American Lumber Standards Committee, there are four basic use categories, with one or more grades in each. The categories are light framing; stud; structural light framing; and structural joists and planks (table 22).

The grades of light framing lumber 2 to 4 inches thick and 2 to 4 inches wide are Construction, Standard, and Utility. Construction and Standard grades, produced primarily by Western and Canadian manufacturers, are commonly combined and sold as “Standard & Better.” They are use for general wall framing, regardless of species. Utility grade, often marketed as “Utility & Better,” can be used for interior framing, plates, blocking, cripples, etc. Economy grade is not accepted by building codes and is not recommended for construction.

Studs are marked in an all-purpose grade, called Stud grade. This grade designation encompasses lumber 2 to 4 inches thick and 2 to 6 inches wide, with a 10-foot length limit. It is most commonly found in 2 by 4 and 2 by 6 sizes, precision-trimmed to specific lengths. When length is not a factor, 2 by 4 Stud grade can be used interchangeably with Standard & Better.

The grades of structural light framing lumber 2 to 4 inches thick and 2 to 4 inches wide are Select Structural, No. 1, No. 2, and No. 3. Availability varies in different markets. The majority of southern pine is produced in these grades, which is not normally available at the retail level in the West. Select Structural and No. 1 are commonly used in engineered applications such as roof and floor trusses.

The grades of structural joist and plank lumber 2 to 4 inches thick and 6 or more inches wide are Select Structural, No. 1, No. 2, and No. 3. The first three, normally

sold together as “No. 2 & Better,” are used primarily for floor joists, ceiling joists, and roof rafters. Span and load-carrying requirements dictate the grade, specifics, and size. No. 3 grade is suitable for shorter spans.

Moisture content

The portion of the grade stamp that designates the condition of seasoning at time of manufacture specifies one of three categories:

- S-GRN Unseasoned, with more than 19 percent moisture content
- S-DRY 19 percent or less moisture content
- MC-15 15 percent or less moisture content

Southern pine producers who kiln-dry their material may use a KD-19 or KD-15 designation to indicate 19-percent or 15-percent moisture content.

Availability of different levels of seasoning varies in local markets. Dimension lumber up to 2 inches thick is available “green” (unseasoned), “dry” (19 percent maximum), or in some areas, “MC-15” or “KD-15” (15 percent maximum). But even in a dry market, the maximum thickness structural grade available seasoned is 2 inches. Lumber thicker than 2 inches is shipped “green.”

The lumber industry produces two sizes of dimension lumber, depending on moisture content: a “dry” size and a slightly larger “green” size. Once the unseasoned size reaches 19-percent moisture content it will be the same size as the dry. “Green” and “dry” sizes should not be mixed during construction, even though their structural properties are identical.

Design Values for Visually Graded Structural Lumber

Design values necessary for engineering calculations to determine the lumber size for specific spans are given in table 23. (Allowable spans are shown in tables 7 and 8.)

Plywood Markings

Plywood products, whether construction or industrial, should be stamped with a marking indicating the intended use of the product. The most widely used markings are those of the American Plywood Association (APA). The markings provide assurance that the product conforms with APA performance standards and/or U.S. Product Standard PS 1–83 for Construction and Industrial Plywood. Typical APA markings are shown in figure 199. The top three markings appear on the face of the panel; the bottom marking is an edge stamp.

Grade

Panel grades are generally identified in terms of the veneer grade used on the face and back of the panel (A-B, B-C, etc.), by a name suggesting the panel's intended end use (APA Rated Sheathing, Underlayment, etc.). The highest quality veneer is "A," the lowest "D." The minimum grade of veneer in exterior plywood is "C." "D" veneer is used only in panels intended for interior use or for applications protected from exposure to weather or moisture.

Span ratings

Some APA trademarked panels, such as APA Rated Sheathing, APA Rated Sturd-I-Floor, and APA 303 Siding, carry numbers in their trademarks called span ratings. These denote the maximum recommended center-to-center spacing, in inches, of supports over which the panel should be placed in construction applications.

APA Rated Sheathing span ratings appear as a set of two numbers separated by a slash, such as 32/16 or 48/24. The first number in the set denotes the maximum recommended spacing of supports when the panel is used for roof sheathing with the long dimension of the panel across three or more supports. The second number indicates the maximum recommended spacing of supports when the panel is used for subflooring with the long dimension of the panel across three or more supports. Thus, panel marked 32/16 may be used for roof sheathing over supports 32 inches on center or for subflooring supports 16 inches on center.

APA Rated Sturd-I-Floor panels are designed for single-floor (combined subfloor-underlayment) applications under carpet and pad. The panels are manufactured with span ratings of 16, 20, 24, and 48 inches. As with APA Rated Sheathing, these are based on application of the panel with the long dimension across three or more supports.

APA 303 Siding is manufactured with span ratings of 16 and 24 inches. It can be applied directly to studs or over nonstructural wall sheathing (Sturd-I-Wall Construction), or over nailable panel or lumber sheathing (double-wall construction). Panels with a span rating of 16 inches may be applied vertically direct to studs spaced 16 inches on center. Panels bearing a span rating of 24 inches may be used vertically direct to studs 24 inches on center. All 303 Siding panels may be applied horizontally direct to studs 16 or 24 inches on center, provided that horizontal joints are blocked. When 303 Siding is used over nailable structural panel or lumber sheathing, the span rating refers to the maximum recommended spacing of vertical rows of nails rather than to stud spacing.

Thickness

This number gives the actual panel thickness.

Species group number

Plywood manufactured under U.S. Product Standard PS 1-83 may be made from over 70 species of wood. These species are divided according to strength and stiffness properties into five groups. Group 1 species are the strongest and stiffest, group 2 the next strongest and stiffest, and so on.

Exposure durability

Plywood panels are produced in four exposure durability classifications: Exterior, Exposure 1, Exposure 2, and Interior.

Exterior panels have a fully waterproof bond. They are designed for applications subject to continuous exposure to the weather or to moisture.

Exposure 1 panels are highly moisture resistant. They are designed to resist moisture during long construction

Table 22—Dimension lumber grades and sizes

Grades	Use Category	Description
Construction, Standard, & Utility	Light framing 2 by 2 through 4 by 4	For use where high strength values are not required (studs, plates, sills, cripples, blocking, etc.).
Stud	Studs 2 by 2 through 4 by 6 10 feet and shorter	An optional all-purpose grade limited to 10 feet and shorter. Characteristics affecting strength and stiffness values are limited so that the grade is suitable for all stud uses, including load-bearing walls.
Select Structural, No. 1, No. 2, & No. 3	Structural light framing 2 by 2 through 4 by 4	Designed to fit engineering applications where higher bending/strength ratios are needed in light framing sizes (for trusses, concrete pier wall forms, etc.).
Select Structural, No. 1, No. 2, & No. 3	Structural joists and planks 2 by 6 through 4 by 16	Designed especially to fit in engineering applications for lumber (joists, rafters and general framing uses)

Table 23—Design Values for Visually Graded Structural Lumber

	For material 2 to 4 inches thick by 2 to 4 inches wide				For material 2 to 4 inches thick by 5 inches or more wide			
	Extreme fiber in bending (9)		Modulus of elasticity (E)	Horizontal shear (H)	Extreme fiber in bending (9)		Modulus of elasticity (E)	Horizontal shear (H)
	Single member uses	Repetitive member uses			Single member uses	Repetitive member uses		
Southern pine (surfaced dry, used at 19% maximum moisture content)								
Select structural	2,000	2,300	1,400,000	90	1,700	1,950	1,400,000	90
No. 1	1,700	1,950	1,400,000	90	1,450	1,650	1,400,000	90
No. 2	1,400	1,600	1,300,000	90	1,200	1,350	1,300,000	90
No. 3	775	875	1,100,000	90	700	800	1,100,000	90
Appearance	1,700	1,950	1,400,000	90	1,450	1,650	1,400,000	90
Stud	775	875	1,100,000	90	700	800	1,100,000	90
Construction	1,000	1,150	1,100,000	90	—	—	—	—
Standard	550	650	1,100,000	90	—	—	—	—
Utility	275	300	1,100,000	90	—	—	—	—
Spruce–pine–fir (surfaced dry or green, used at 19% maximum moisture content)								
Select structural	1,450	1,650	1,500,000	70	1,250	1,450	1,500,000	70
No. 1	1,200	1,400	1,500,000	70	1,050	1,200	1,500,000	70
No. 2	1,000	1,150	1,300,000	70	875	1,000	1,300,000	70
No. 3	550	650	1,200,000	70	500	575	1,200,000	70
Appearance	1,200	1,400	1,500,000	70	1,050	1,200	1,500,000	70
Stud	550	650	1,200,000	70	500	575	1,200,000	70
Construction	725	850	1,200,000	70	—	—	—	—
Standard	400	475	1,200,000	70	—	—	—	—
Utility	175	225	1,200,000	70	—	—	—	—
Hem–fir (surfaced dry or green, used at 19% maximum moisture content)								
Select structural	1,650	1,900	1,500,000	75	1,400	1,650	1,500,000	75
No. 1	1,400	1,600	1,500,000	75	1,200	1,400	1,500,000	75
No. 2	1,150	1,350	1,400,000	75	1,000	1,150	1,400,000	75
No. 3	650	725	1,200,000	75	575	675	1,200,000	75
Appearance	1,400	1,600	1,500,000	75	1,200	1,400	1,500,000	75
Stud	650	725	1,200,000	75	575	675	1,200,000	75
Construction	825	975	1,200,000	75	—	—	—	—
Standard	475	550	1,200,000	75	—	—	—	—
Utility	225	250	1,200,000	75	—	—	—	—
<i>Douglas–fir</i> south (surfaced dry or green, used at 19% maximum moisture content)								
Select structural	2,000	2,300	1,400,000	90	1,700	1,950	1,400,000	90
No. 1	1,700	1,950	1,400,000	90	1,450	1,650	1,400,000	90
No. 2	1,400	1,600	1,300,000	90	1,200	1,350	1,300,000	90
No. 3	775	875	1,100,000	90	700	800	1,100,000	90
Appearance	1,700	1,950	1,400,000	90	1,450	1,650	1,400,000	90
Stud	775	875	1,100,000	90	700	800	1,100,000	90
Construction	1,000	1,150	1,100,000	90	—	—	—	—
Standard	550	650	1,100,000	90	—	—	—	—
Utility	275	300	1,100,000	90	—	—	—	—

Source: National Forest Products Association. National Design Specification: Wood Construction, Supplement to the 1986 Edition. Table 4A. The species and grades selected from Table 4a and reproduced here reflect those most commonly used for framing.

delays, or exposure to similarly demanding conditions. However, only exterior panels should be used for permanent exposure to weather or moisture.

Exposure 2 panels are intended for protected construction applications involving only moderate delays in providing protection from moisture.

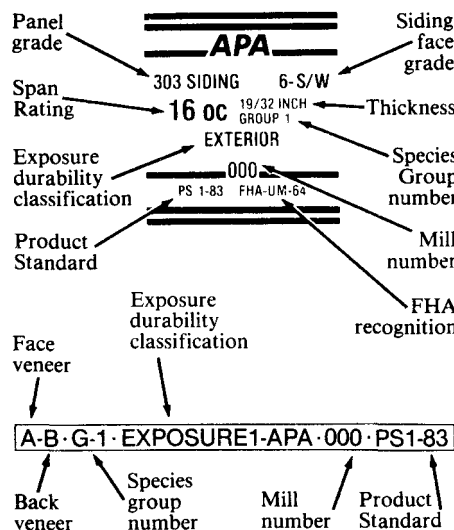
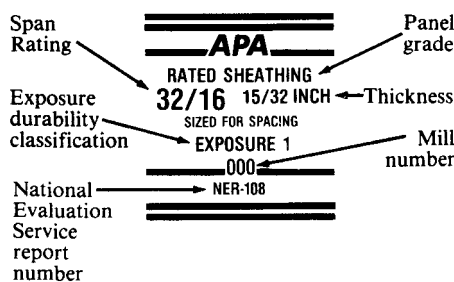
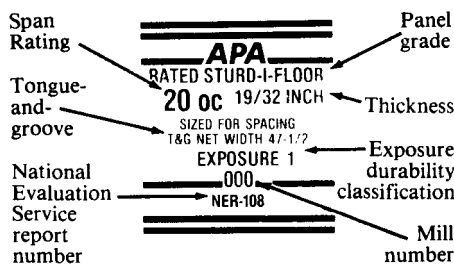
Interior panels which lack further glueline information in their markings are manufactured with interior glue and are intended for interior applications only.

Mill number

The mill number is the identification number assigned to the manufacturing facility in which the panel was produced.

Figure 199—Typical American Plywood Association (APA) markings designating performance standards.

TYPICAL APA REGISTERED TRADEMARKS



Product standard

U.S. Product Standard PS 1-83 for Construction and Industrial Plywood is a voluntary commodity standard developed cooperatively by the U.S. Department of Commerce and the construction and industrial plywood industry.

APA performance standards are the result of new manufacturing technology that makes possible the manufacture of structural panel products from wood

byproducts and species not provided for in U.S. Product Standard PS 1-83.

Panels produced under APA performance standards are called APA Performance-Rated Panels.

In addition to conventional veneer plywood, APA performance standards encompass such panel products as composites, waferboard, oriented strand board, and structural particleboard.

Finishing Pressure-Treated Wood

Wood that is pressure-treated with waterborne salts can be stained or painted in the same manner as untreated wood.

Wood that is treated with oilborne preservatives can be stained or painted if liquid petroleum gas (LPG), methylene chloride, or other light hydrocarbon solvent has been used as the preservative carrier. It should be specified when ordering that the material be suitable for staining or painting.

Wood that is treated with creosote, creosote solutions, or oilborne preservatives in heavy hydrocarbon solvent generally cannot be successfully stained or painted.

Prolonged exposure to wood-preserving chemicals may present a health hazard. To minimize exposure, one should: 1) wear protective gloves and clothing; 2) wear goggles and dust mask when sawing, machining, or sanding for prolonged periods of time; 3) perform all sawing, boring, planing, and sanding outdoors or in well ventilated areas; 4) wash exposed areas of body with soap and water after handling pressure-treated materials; 5) wash all clothing that was worn while the material was being handled; and 6) avoid burning scraps of pressure-treated lumber in open fires or in a fireplace, stove, or similar device. The preferred method of disposing of pressure-treated scrap pieces is to bury them at a suitable waste disposal facility.

Nailing Schedules

Table 24 lists many of the components that are used in home construction and recommendations for how to join these components. The proper number and size of nails, and method of nailing are essential to ensure the structural integrity of a house. A nail should never be too big, too small, or placed improperly.

Square Corners

Square corners in house construction ensure that all elements of the house fit together as planned, thus simplify-

Table 24—Nailing schedules

Materials being joined	Nailing method	No.	Nail size	Nailing procedures
Header to joists	Endnail	3	12d	Joist hangers advised
Joist to sill or girder	Toenail	2	8d	
Header and stringer joist to sill	Toenail		8d	24 inch on center
Subfloor, boards				
1 by 6 inch and smaller		2	8d	To each joist
1 by 8 inch		3	8d	To each joist
Subfloor, plywood				
At edges			8d	6 inch on center
At intermediate joists			8d	8 inch on center
Subfloor (2 by 6 inch, tongue and groove to joist or girder)	Blind-nail (casing) and facenail	2	12d	
Soleplate to stud, horizontal assembly	Endnail	2	12d	At each stud
Top plate to stud	Endnail	2	12d	
Soleplate to joist or blocking	Facenail		12d	24 inch on center maximum
Doubled studs	Facenail		12d	24 inch on center, staggered
End stud of intersecting wall to exterior wall stud	Facenail		12d	24 inch on center
Upper top plate to lower top plate	Facenail		12d	24 inch on center
Upper top plate, laps and intersections	Facenail		12d	
Header, two pieces			12d	12 inch on center, staggered
Ceiling joist to top wall plates	Toenail	2	8d	
Ceiling joist laps at partition	Facenail	3	12d	
Rafter to top plate	Toenail	2	8d	
Rafter to ceiling joist	Facenail	3	12d	
Rafter to valley or hip rafter	Toenail	3	8d	
Ridge board to rafter	Endnail	3	12d	
Rafter to rafter through ridge board	Toenail	3	12d	
Collar beam to rafter				
2-inch member	Facenail	2	12d	
1-inch member	Facenail	3	8d	
1-inch diagonal let-in brace to each stud and plate (4 nails at top)		2	8d	
Built-up corner studs				
Studs to blocking	Facenail	2	10d/12d	Each side
Intersecting stud to corner studs	Facenail	2	12d	24 inch on center
Built-up girders and beams, three or more members	Facenail		10d/12d	12 inch on center, staggered, each layer
			10d/12d	
Wall sheathing:				
1 by 8 inch or less, horizontal	Facenail	2	8d	At each stud
Wall sheathing, vertically applied plywood.				
$\frac{3}{8}$ inch and less thick	Facenail		6d	6 inch on center at edges
$\frac{1}{2}$ inch and over thick	Facenail		8d	12 inch on center intermediate
Wall sheathing, vertically applied fiberboard				
$\frac{1}{2}$ inch thick	Facenail			1 $\frac{1}{2}$ -inch roofing nail, 3 inch on center at edges and 6 inch on center intermediate
Roof sheathing, boards, 4-, 6-, 8-inch width	Facenail	2	8d	At each rafter
Roof sheathing, plywood				
$\frac{3}{8}$ inch and less thick	Facenail		6d	6 inch on center at edges and 12 inch on center intermediate
$\frac{1}{2}$ inch and over thick	Facenail		8d	

ing the installation of such items as sheathing, gypsum wallboard, cabinets, carpeting, counter tops, wallpaper, etc. The recommended method of establishing square comers involves the use of a pocket calculator and the Pythagorean theorem. The Pythagorean theorem states that, in a right triangle, the length of the hypotenuse (C) is equal to the square root of the sum of the squares of the lengths of the other two sides (A and B).

$$C = \sqrt{A^2 + B^2}$$

Applying this to footing layout begins by squaring the length of each of the two sides of the building, adding these two answers together, and taking the square root of the sum to produce the exact length of the diagonal that will produce a perfectly square comer for the footings.

The simplest approach to solving this arithmetic problem is to use a pocket calculator designed to work in feet and inches. If such a calculator is not available, the

dimensions will have to be converted to feet and decimal parts of a foot. (Alternatively, inches could be used as the unit of measurement.) For example, 12 feet 6 inches would have to be converted to 12.5 feet.

Converting dimensions in feet and inches to decimal form

Given a dimension of 25 feet $3\frac{7}{8}$ inches, start the conversion by dividing the 7 by 8 to get 0.875 inch. Add this to the 3 inches to get 3.875 inches. Then divide the 3.875 inches by 12 to get 0.32292 foot. Add this result to the 25 to get 25.32292 feet, which is the decimal equivalent of 25 feet $3\frac{7}{8}$ inches.

Converting dimensions in decimal form to feet and inches

Given a dimension of 44.71875 feet, start by setting aside the 44 feet and multiplying the decimal part (0.71875) by 12 to get 8.625 inches. Set aside the 8 inches and multiply the decimal part by 8 to get $\frac{5}{8}$ inch. The result of the conversion is 44 feet $8\frac{5}{8}$ inches, which is the feet and inches equivalent of 44.71875 feet.

Example of squaring a foundation layout

A rectangular house is to have a foundation wall with outside dimensions of 52 by 32 feet. Squaring these two numbers and adding the squared values gives a value of 3,728. The square root of 3,728 is 61.05735 feet. Setting aside the 61 feet and multiplying the decimal part (0.05735) by 12 gives 0.68820 inch. This means that the fractional part of a foot is less than 1 inch. Multiplying the 0.68820 by 8 gives 5.5 eighths of an inch or eleven-sixteenths of an inch. Therefore the exact length of the diagonal between the outside corners of the foundation wall should be 61 feet $\frac{11}{16}$ inch, which is the feet and inches equivalent of 61.05735 feet. If the foundation walls are placed so that the length of the diagonal between the outside corners of the wall is 61 feet $\frac{11}{16}$ inch, then the foundation has square corners.

SELECTED BIBLIOGRAPHY



- American Institute of Steel Construction. 1980. Manual of Steel Construction, 8th ed. Chicago, IL: American Institute of Steel Construction. 800 p., illus.
- Describes principles, specifications, and practices of steel construction.*
- American Plywood Association. 1979. APA design/construction guide: Residential & commercial. Tacoma, WA: American Plywood Association. 55 p., illus.
- Designed as a handy reference manual for panel specifiers and users. Contains information on panel grades plus APA specifications for floor, wall, and roof systems.*
- American Plywood Association. 1984. APA product guide: Grades & specifications. Tacoma, WA: American Plywood Association. 27 p., illus.
- A useful reference for structural wood panel users, specifiers, dealers, and distributors. Illustrates and explains APA trademarks appearing on panel products.*
- American Plywood Association. 1978. All-weather wood foundation. Tacoma, WA: American Plywood Association. 37 p., illus.
- Describes and illustrates construction of an all-weather wood foundation with either full basement or crawl space. A list of other information sources is included.*
- American Wood Preservers Institute. 1975. FHA pole house construction, 2d ed. McLean, VA: American Wood Preservers Institute. 32 p., illus.
- An updated edition of an FHA publication first issued in 1969. Describes a variety of ways to use pole frame designs effectively.*
- NAHB Research Foundation. 1975. All-weather home building manual. Guideline 14. Washington, DC: U.S. Department of Housing and Urban Development and U.S. Department of Labor. 143 p., illus.
- Written for the home builder, this manual describes practices that permit construction to continue in cold, wet, or hot and dry weather.*
- NAHB Research Foundation. 1977. Reducing home building costs with OVE design and construction. Washington, DC: National Association of Home Builders. 135 p., illus.
- Describes a practical series of optimum value engineered (OVE) cost-reducing techniques covering each stage of home building.*
- NAHB Research Foundation. 1979. Insulation Manual. Homes and apartments. Rockville, MD: NAHB Research Foundation. 149 p., illus.
- Provides information on the proper installation, use, economics, and benefits of insulation, and guidance on other energy-conserving techniques for designing and building homes.*
- NAHB Research Foundation. 1982. Off-center spliced floor joists. Research Reports Vol. 4. Washington, DC: National Association of Home Builders. 58 p., illus.
- A manual on the design, fabrication, and installation of off-center spliced floor joists.*
- NAHB Research Foundation. 1983. Plywood headers for residential construction. Research Reports Vol. 5. Washington, DC: National Association of Home Builders. 48 p., illus.
- A manual on the design, fabrication, and installation of plywood box headers.*
- NAHB Research Foundation. 1983. Residential concrete. Washington, DC: National Association of Home Builders. 71 p., illus.
- Provides guidelines for ordering ready mixed concrete. Admixtures such as accelerators, retarders, plasticizers, and superplasticizers are discussed. Extensive illustrations are provided on form building, jointing, and basement leakage control.*
- NAHB Research Foundation. 1984. Truss-framed construction. Rockville, MD: NAHB Research Foundation. 48 p., illus.
- A manual of design and construction for the truss-frame system, which combines roof truss, floor truss, and wall studs into a rigid unit frame.*

National Forest Products Association. 1983. All-weather wood foundation system: Design, fabrication, and installation manual. Washington, DC: National Forest Products Association. 94 p., illus.

Part I of this three-part manual addresses structural design, detailing, and material specifications for architects, engineers, draftsmen, and builders. Part II covers quality fabrication of the foundation. Part III deals with installation methods. Parts II and III are particularly useful to builders and fabricators of treated wood foundations.

Rudder, F. F., Jr. 1985. Airborne sound transmission loss characteristics of wood-frame construction. Gen. Tech. Rep. FPL-43. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 27 p., illus.

Summarizes available data on the airborne sound transmission loss properties of wood-frame construction and evaluates the method for predicting the loss.

GLOSSARY OF HOUSING TERMS



Air-dried lumber. Lumber that has been piled in yards or sheds for any length of time. For the United States as a whole, the minimum moisture content of thoroughly air-dried lumber is 12 to 15 percent and the average is somewhat higher.

Anchor bolt. A bolt to secure a wooden sill plate to concrete or masonry floor or foundation wall.

Apron. The flat member of the inside trim of a window placed against the wall immediately beneath the stool.

Asphalt. Most native asphalt is a residue from evaporated petroleum. It is insoluble in water but soluble in gasoline and melts when heated. Used widely as a waterproofing agent in the manufacture of waterproof roof coverings of many types, exterior wall coverings, flooring tile, and the like.

Attic ventilator. A screened opening provided to ventilate an attic space. They are located in the soffit area as inlet ventilators and in the gable end or along the ridge as outlet ventilators. Attic ventilation can also be provided by means of power-driven fans. See also Louver.

Backfill. The replacement of excavated earth into a trench around and against a basement foundation.

Backhoe. A machine that digs narrow, deep trenches for foundations, draisile, cable, etc.

Baluster. A vertical member in a railing used on the edge of stairs, balconies, and porches.

Balustrade. A railing made up of balusters, top rail, and sometimes bottom rail.

Band joist. See under Joist, band.

Base or Baseboard. A board placed against the wall around a room next to the floor.

Base molding. Molding used to trim the upper edge of baseboard.

Base shoe. Molding used next to the floor on baseboard. Sometimes called a carpet strip.

Batten. A narrow strip of wood used to cover joints or as decorative vertical members over plywood or wide boards.

Batter board. One of a pair of horizontal boards nailed to posts set at the corners of an excavation, used to indicate the desired level. They are also used as fastenings for stretched strings to indicate outlines of foundation walls.

Bay window. Any window space projecting outward from the walls of a building, either square or polygonal in plan.

Beam. A structural member supporting a load applied transversely to the member.

Bearing partition. A partition that supports any vertical load in addition to its own weight.

Bearing wall. A wall that supports any vertical load in addition to its own weight.

Bedding. A layer of mortar into which brick or stone is set.

Berm. A raised area of earth such as earth pushed against a wall.

Blind-nailing. Nailing in such a way that the nailheads are not visible on the face of the work. Blind nailing is usually done at the tongue of matched boards.

Bolster. A short horizontal wood or steel beam on top of a column to support and decrease the span of beams or girders.

Boston ridge. A method of applying shingles at the ridge or hips of a roof as a finish.

Brace. An inclined piece of framing lumber applied to wall or floor to stiffen the structure. Often used temporarily on walls until framing has been completed.

Breather paper. A paper that lets water vapor pass through, often used on the outer face of walls to stop wind and rain while not trapping water vapor.

Brick veneer. A facing of brick laid against and fastened to the sheathing of a frame wall or tile wall construction.

Bridging. Small wood or metal members inserted in a diagonal position between the floor joists at midspan to brace the joists.

Built-up roof. A roofing composed of three to five layers of asphalt felt laminated with coal tar, pitch, or asphalt. The top layer is covered with crushed slag or gravel. Generally used on flat or low-pitched roofs.

Butt joint. The junction where the ends of two timbers or other members meet in a square-cut joint.

Cantilever. A horizontal structural component that projects beyond its support, such as a second-story floor that projects out from the wall of the first floor.

Cant strip. A triangular-shaped piece of lumber used at the junction of a flat deck and a wall to prevent cracking of the roofing that is applied over it.

Cap. The upper member of a column, pilaster, door cornice, or molding.

Carriage. See Stringer.

- Casement frame and sash.** A frame of wood or metal enclosing part or all of a sash, which can be opened by means of hinges affixed to the vertical edge.
- Casing.** Molding of various widths, forms, and thicknesses, used to trim door and window openings at the jambs.
- Caulk.** To fill or close a joint with a seal to make it watertight and airtight. The material used to seal a joint.
- Cement mortar.** A mixture of cement with sand and water used as a bonding agent between bricks or stones.
- Chalking string.** A string covered with chalk that, when stretched between two points and snapped, marks a straight line between the points.
- Chamfer.** The beveled edge of a board.
- Checking.** Fissures that can appear with age in exterior paint coatings. Such fissures, at first superficial, may in time penetrate entirely through the coating.
- Check rails.** Also called meeting rails. The upper rail of the lower sash and the lower rail of the upper sash of a double-hung window. Meeting rails are made sufficiently thicker than the rest of the sash frame to close the opening between the two sashes. Check rails are usually beveled to insure a tight fit between the two sashes.
- Clear wood.** Wood that has no knots.
- Cleat.** A length of wood fixed to a surface, as a ramp, to give a firm foothold or to maintain an object in place.
- Collar beam.** A member nominally 1 or 2 inches thick connecting opposite roof rafters at or near the ridge board. Collar beams serve to stiffen the roof structure.
- Column.** In architecture: A vertical supporting member, circular or rectangular in section, usually consisting of a base, shaft, and capital. In engineering: A vertical structural compression member that supports loads acting in the direction of its longitudinal axis.
- Condensation.** Beads or films of water, or frost in cold weather, that accumulate on the inside of the exterior covering of a building when warm, moisture-laden air from the interior reaches a point where the temperature no longer permits the air to sustain as vapor the moisture it holds.
- Construction, frame.** A type of construction in which the structural parts are wood or depend upon a wood frame for support. In codes, if masonry veneer is applied to the exterior walls, the structure is still classified as frame construction.
- Control joint.** A joint that penetrates only partially through a concrete slab or wall so that if cracking occurs it will be a straight line at that joint.
- Coped joint.** See Scribing.
- Corner board.** A board used as trim for the external corner of a house or other frame structure, against which the ends of siding are butted.
- Corner brace.** A diagonal brace placed at the corner of a frame structure to stiffen and strengthen the wall.
- Cornice.** Overhang of a pitched roof at the eave line, usually consisting of a fascia board, a soffit for a closed cornice, and appropriate moldings.
- Cornice return.** The underside of the cornice at the corner of the roof where the walls meet the gable end roofline. The cornice return serves as trim rather than as a structural element, providing a transition from the horizontal eave line to the sloped roofline of the gable.
- Counterflashing.** A flashing usually used on chimneys at the roofline to cover shingle flashing and to prevent moisture entry.
- Course.** A continuous horizontal range of blocks, bricks, siding boards, or shingles.
- Cove molding.** A molding with a concave face used as trim or to finish interior corners.
- Crawl space.** A shallow space below the living quarters of a basementless house, normally enclosed by the foundation wall.
- Cricket.** See Saddle.
- Crimp.** A crease formed in sheet metal for fastening purposes or to make the material less flexible.
- Crown molding.** A molding used on cornice or wherever an interior angle is to be covered. If a molding has a concave face, it is called a cove molding.
- Dead load.** The weight, expressed in pounds per square foot, of elements that are part of the structure.
- Deadman timber.** A large buried timber used as an anchor as for anchoring a retaining wall.
- Decay.** Disintegration of wood or other substance through the action of fungi, as opposed to insect damage.
- Deck paint.** An enamel with a high degree of resistance to mechanical wear, designed for use on such surfaces as porch floors.
- Deformed shank nail.** A nail with ridges on the shank to provide better withdrawal resistance. See under Nail.
- Density.** The mass of substance in a unit volume. When expressed in the metric system, it is numerically equal to the specific gravity of the same substance.
- Dewpoint.** Temperature at which a vapor begins to deposit as a liquid. Applies especially to water in the atmosphere.
- Dimension.** See Lumber, dimension.
- Doorjam, interior.** The surrounding case into which and out of which a door closes and opens. It consists of two upright pieces, called side jambs, and a horizontal head jamb.
- Dormer.** A roofed projection from a sloping roof, into which a dormer window is set. See eye dormer and shed dormer.
- Downspout.** A pipe, usually of metal, for carrying rain-water from roof gutters.
- Dressed and Matched.** See Tongue and groove.

Drip. (1) A structural member of a cornice or other horizontal exterior-finish course that has a projection beyond the parts for water runoff. (2) A groove in the underside of a sill or drip cap to cause water to run off on the outer edge.

Drip cap. A molding placed on the exterior top side of a door or window frame to cause water to run off beyond the outside of the frame.

Drywall. Interior covering material which is applied in large sheets or panels. The term has become basically synonymous with gypsum wallboard.

Ducts. Round or rectangular metal pipes for circulating warm air in a forced air heating or air-conditioning system.

Eave. The lower margin of a roof projecting over the wall.

Edgenailing. Nailing into the edge of a board. See Nail.

Endnailing. Nailing into the end of a board, which results in very poor withdrawal resistance. See Nail.

Expansion joint. A bituminous fiber strip used to separate blocks or units of concrete to prevent cracking caused by expansion as a result of temperature changes. Also used on concrete slabs.

Eye dormer. A dormer that has a gable roof.

Facenailing. Nailing perpendicular to the initial surface being penetrated. Also termed direct nailing.

Fascia. A flat board, band, or face, used by itself or, more often, in combination with moldings, generally located at the outer face of the cornice.

Fascia backer. The main structural support member to which the fascia is nailed.

Filler. A heavily pigmented preparation used for filling and leveling off the pores in open-pored woods.

Fire stop. A solid, tight closure of a concealed space, placed to prevent the spread of fire and smoke. In a frame wall, this usually consists of 2 by 4 cross blocking between studs.

Flagstone (flagging or flags). Flat stones, from 1 to 4 inches thick, used for rustic walks, steps, and floors.

Flashing. Sheet metal or other material used in roof and wall construction to prevent water entry into adjoining parts of the structure.

Flat paint. An interior paint that contains a high proportion of pigment, and dries to a flat or lusterless finish.

Flue. The space or passage in a chimney through which smoke, gas, or fumes ascend. Each such passage is called a flue, which together with any others and the surrounding masonry make up the chimney.

Flue lining. Fire clay or terra cotta pipe, round or square, usually made in all ordinary flue sizes and in 2-foot lengths, used for the inner lining of chimneys with the brick or masonry work around the outside. Flue lining in chimneys runs from about a foot below the flue connection to the top of the chimney.

Fly rafters. End rafters of the roof overhang supported by sheathing and lookouts.

Footing. A concrete section in a rectangular form, wider than the bottom of the foundation wall or pier it supports. With a pressure-treated wood foundation, a gravel footing may be used in place of concrete.

Formwork. A temporary mold for giving a desired shape to poured concrete.

Foundation. The supporting portion of a structure below the first-floor construction, or below grade.

Framing, balloon. A system of framing in which all exterior studs extend in one piece from the sill plate to the roof plate.

Framing, ladder. Framing for the roof overhang at a gable. Cross pieces are used similar to a ladder to support the overhang.

Framing, platform. A system of framing in which floor joists of each story rest on the top plates of the story below or on the foundation sill for the first story, and the bearing walls and partitions rest on the subfloor of each story.

Frieze. A horizontal member connecting the top of the siding with the soffit of the cornice.

Frost line. The depth of frost penetration in soil. This depth varies in different parts of the country.

Fungi, wood. Microscopic plants that live in damp wood and cause mold, stain, and decay.

Fungicide. A chemical that is poisonous to fungi.

Furring. Strips of wood or metal applied to a wall or other surface to even it and to serve as a fastening base for finish material.

Gable. The portion of the roof above the eave line of a double-sloped roof.

Gable end. An end wall having a gable.

Gambrel. A roof that slopes steeply at the edge of the building, but changes to a shallower slope across the center of the building. This allows the attic to be used as a second story.

Gloss paint, Gloss enamel. A paint or enamel that contains a relatively low proportion of pigment and dries to a sheen or luster.

Glueline, exterior. Waterproof glue at the interface of two veneers of plywood.

Girder. A large or principal beam of wood or steel used to support loads at points along its length.

Grade. The ground level around a building. The natural grade is the original level. Finished grade is the level after the building is complete and final grading is done.

Grain. The direction, size, arrangement, appearance, or quality of the fibers in wood.

Grain, edge or vertical. Edge-grain lumber has been sawed parallel to the pith of the log and approximately at right angles to the growth rings; i.e., the rings form an angle of 45° or more with the wide surface of the piece.

Grain, flat. Flat-grain lumber has been sawed parallel to the pith of the log and approximately tangential to the growth rings, i.e., the rings form an angle of less than 45° with the surface of the piece.

Grout. Mortar that will flow into the joints and cavities of masonry work and fill them solidly.

Gusset. A flat wood, plywood, or similar type member used to provide a connection at intersections of wood members. Most commonly used in joints of wood trusses.

Gutter or eave trough. A shallow channel or conduit of metal or vinyl set below and along the eaves of a house to catch and carry off rainwater from the roof.

H-clip. A metal clip into which edges of adjacent plywood sheets are inserted to hold edges in alignment.

Header. (1) A beam placed perpendicular to joists, to which joists are nailed in framing for chimneys, stairways, or other openings. (2) A wood lintel.

Hearth. The inner or outer floor of a fireplace, usually made of brick, tile, or stone.

Heartwood. The wood extending from the pith to the sapwood, the cells of which no longer participate in the life process of the tree.

Heel wedges. Triangular shaped pieces of wood that can be driven into gaps between rough framing and finished items, such as window frames, to provide a solid backing for these items.

Hip. The external angle formed by the meeting of two sloping sides of a roof.

Hip roof. A roof that rises by inclined planes from all four sides of a building.

Hopper window. A window that is hinged at the bottom to swing inward.

Humidifier. A device designed to increase the humidity within a room or a house by means of the discharge of water vapor. Humidifiers may consist of individual room-size units or larger units attached to the heating plant to condition the entire house.

I-beam. A steel beam with a cross section resembling the letter I. I-beams are used for long spans as basement beams or over wide wall openings, such as a double garage door, when wall and roof loads are imposed on the opening.

Insulation board, rigid. A structural building board made of coarse wood or cane fiber impregnated with asphalt or given other treatment to provide water-resistance. It can be obtained in various size sheets, in various thicknesses, and in various densities.

Insulation, thermal. Any material high in resistance to heat transmission that, when placed in the walls, ceiling, or floors of a structure, reduces the rate of heat flow.

Isolation joint. A joint in which two incompatible materials are isolated from each other to prevent chemical action between the two.

Jack rafter. A rafter that spans the distance from the wall plate to a hip, or from a valley to a ridge.

Jackstud. A short stud that does not extend from floor to ceiling, for example, a stud that extends from the floor to a window.

Jamb. The side and head lining of a doorway, window, or other opening.

Joint. The space between the adjacent surfaces of two members or components that are held together by nails, glue, cement, mortar, or other means. *See* Control joint, Coped joint, Expansion joint, and Isolation joint.

Joint cement. A powder that is usually mixed with water and used for joint treatment in gypsum wallboard finish. Joint cement, often called "spackle," can be purchased in a ready-mixed form.

Joist. One of a series of parallel beams, usually 2 inches in thickness, used to support floor and ceiling loads, and supported in turn by larger beams, girders, or bearing walls. *See* Band joist, Header, Tail beam, and Trimmer.

Kerf. A cut or incision made by a saw in a piece of wood.

Keyways. A tongue-and-groove type connection where perpendicular planes of concrete meet to prevent relative movement between the two components.

Kiln-dried lumber. Lumber that has been dried by means of controlled heat and humidity, in ovens or kilns, to specified ranges of moisture content. *See also* Air-dried lumber and Lumber, moisture content.

Knee wall. A short wall extending from the floor to the roof in the second story of a 1½-story house.

Landing. A platform between flights of stairs or at the termination of a flight of stairs.

Lath. The base to which plaster is applied. Expanded metal is commonly used.

Lay up. To place materials together in the relative positions they will have in the finished building.

Ledger strip. A strip of lumber nailed along the bottom of the side of a girder, on which joists rest.

Let-in brace. A board nominally 1 inch thick applied diagonally into notched studs.

Light. Space in a window sash for a single pane of glass. Also, a pane of glass.

Lintel. A horizontal structural member that supports the load over an opening such as a door or window. Also called a header.

Live load. The load, expressed in pounds per square foot, of people, furniture, snow, etc., that are in addition to the weight of the structure itself.

Lookout. A short wood bracket or cantilever to support an overhang portion of a roof, usually concealed from view by a soffit.

Louver. An opening with a series of horizontal slats arranged to permit ventilation but to exclude rain, sunlight, or vision. *See also* Attic ventilators.

Lumber, boards. Lumber less than 2 inches thick and 2 or more inches wide.

Lumber, dimension. Lumber from 2 inches to, but not including, 5 inches thick and 2 or more inches wide. Includes joists, rafters, studs, plank, and small timbers.

Lumber, dressed size. The dimension of lumber after shrinking from green dimension and after machining to size or pattern.

Lumber, matched. *See* Tongue and groove.

Lumber, moisture content. The weight of water contained in wood, expressed as a percentage of the total weight of the wood. *See also* Air-dried lumber and Kiln-dried lumber.

Lumber, pressure-treated. Lumber that has had a preservative chemical forced into the wood under pressure to resist decay and insect attack.

Lumber, shiplap. Lumber that has been milled along the edge to make a close rabbeted or lapped joint.

Lumber, timbers. Lumber 5 or more inches in least dimension. Includes beams, stringers, posts, caps, sills, girders, and purlins.

Mansard. A type of roof that slopes very steeply around the perimeter of the building to full wall height, providing space for a complete story. The center portion of the roof is either flat or very low sloped.

Mantel. The shelf above a fireplace. Also used in referring to the trim around both top and sides of a fireplace opening.

Masonry. Stone, brick, concrete, hollow-tile, concrete-block, gypsum-block, or other similar building units or materials or a combination of the same, bonded together with mortar to form a wall, pier, buttress, or similar element.

Mastic. A pasty material used as a cement in such applications as setting tile or as a protective coating for thermal insulation or waterproofing.

Mildewcide. A chemical that is poisonous specifically to mildew fungi. A specific type of fungicide.

Millwork. Building materials made of finished wood and manufactured in millwork plants and planing mills. It includes such items as inside and outside window and door frames, blinds, porchwork, mantels, panelwork, stairways, molding, and interior trim. The term does not include flooring or siding.

Miter joint. The joint of two pieces at an angle that is half the joining angle. For example, the miter joint at the side and head casing at a door opening is made at a 45° angle.

Moisture content of wood. *See* Lumber, moisture content.

Molding. A wood strip having a curved or projecting surface used for decorative purposes.

Mortar. *See* Cement mortar.

Mortise. A slot cut into a board, plank, or timber, usually edgewise, to receive a tenon of another board, plank, or timber to form a joint.

Mullion. The vertical member of a window between openings in a multiple-opening frame.

Muntin. A short bar, horizontal or vertical, separating panes of glass in a window sash.

Natural finish. A transparent finish that does not seriously alter the original color or obscure the grain of the natural wood. Natural finishes are usually provided by sealers, oils, varnishes, water-repellent preservatives, and other similar materials.

Newel. A post to which the end of a stair railing or balustrade is fastened. Also, any post to which a railing or balustrade is fastened.

Nominal. Of wood dimension, the approximate size of a sawn wood section before it is planed.

Nonbearing wall. A wall supporting no load other than its own weight.

Nosing. The projecting edge of a molding or drip. Usually applied to the projecting molding on the edge of a stair tread.

Notch. A crosswise rabbet at the end of a board.

On center (O.C.). The measurement of spacing for elements such as studs, rafters, and joists, from the center of one member to the center of the next.

Oriented strand board (OSB). A type of structural flakeboard composed of layers, with each layer consisting of compressed strand-like wood particles in one direction, and with layers oriented at right angles to each other. The layers are bonded together with a phenolic resin.

Panel. (1) A thin flat piece of wood, plywood, or similar material, framed by stiles and rails as in a door or fitted in grooves of thicker material with molded edges for decorative wall treatment. (2) A sheet of plywood, fiberboard, structural flakeboard, or similar material.

Paper, building. A general term for papers, felts, and similar sheet materials used in construction.

Parquet. A floor with inlaid design. For wood flooring it is often laid in blocks with boards at angles to each other to form patterns.

Particleboard. Panels composed of small wood particles usually arranged in layers without a particular orientation and bonded together with a phenolic resin. Some particleboards are structurally rated *See also* Structural flakeboard.

Partition. A wall that subdivides spaces within any story of a building.

Penny. As applied to nails, it originally indicated the price per hundred. The term now serves as a measure of nail length and is signified by the letter d.

Perm. A measure of water vapor movement through a material, for permeation, measured as grains per square foot per hour per inch of mercury difference in vapor pressure.

Pier. A column of masonry, usually rectangular in horizontal cross section, used to support other structural members.

Pigment. A powdered solid in suitable degree of subdivision for use in adding color to paint or enamel.

Pilaster. A projection from a wall forming a column to support the end of a beam framing into the wall.

Pitch. The measure of the steepness of the slope of a roof, expressed as the ratio of the rise of the slope over a corresponding horizontal distance. Roof slope is expressed in the inches of rise per foot of run, such as 4 in 12.

Pitch board. A template used for marking the rise and run on a stair carriage.

Pith. The small, soft core at the original center of a tree around which wood formation takes place.

Plate. Sil! plate: a horizontal member anchored to a masonry wall. Sole plate: bottom horizontal member of a frame wall. Top plate: top horizontal member of a frame wall supporting ceiling joists, rafters, or other members.

Plenum. A space in which air is contained under slightly greater than atmospheric pressure. In a house, it is used to distribute heated or cooled air.

Plumb. Exactly vertical.

Plumb bob. A weight on the end of a line used to show vertical direction.

Ply. A term denoting one thickness of any material used for building up of several layers, such as roofing felt, veneer in plywood, or layers in built-up materials.

Plywood. A piece of wood made of three or more layers of veneer joined with glue, usually laid with the grain of adjoining plies at right angles

Post and beam roof. A roof consisting of thick planks spanning between beams that are supported on posts. This construction has no attic or air space between the ceiling and roof.

Primer. The first coat of paint in a paint job that consists two or more coats; also the paint used for such a first coat.

Purlin. A horizontal timber supporting the common rafters in roofs.

Quarter round. A small molding that has the cross section of a quarter circle.

Quartersawn. Another term for edge grain, which see.

Rabbet. A rectangular longitudinal groove cut in the corner edge of a board or plank.

Rafter. One of a series of structural members of a roof designed to support roof loads. The rafters of a flat roof are sometimes called roof joists. See also Fly rafter and Jack rafter.

Rafter, hip. A rafter that forms the intersection of an external roof angle.

Rafter, valley A rafter that forms the intersection of an internal roof angle. A valley rafter is normally made of double 2-inch-thick members.

Rail. (1) A cross member of a panel door or sash. (2) The upper or lower member of a balustrade or staircase extending from one vertical support, such as a post, to another.

Rake. Trim members that run parallel to the roof slope and form the finish between the wall and a gable roof extension.

Reflective insulation. Sheet material with one or both surfaces of comparatively low heat emissivity, such as aluminum foil. When it is used in building construction, the surfaces face air spaces, reducing the radiation across these spaces.

Register. A device for controlling the flow of warmed or cooled air through an opening.

Reinforcing. Steel rods or metal fabric placed in concrete slabs, beams, or columns to increase their strength.

Relative humidity. The amount of water vapor in the atmosphere, expressed as a percentage of the maximum quantity that the atmosphere could hold at a given temperature. The amount of water vapor that can be held in the atmosphere increases with the temperature.

Resorcinol. An adhesive that is high in both wet and dry strength and resistant to high temperatures. It is used for gluing lumber or assembly joints that must withstand severe conditions.

Reverse board and batten. Siding in which narrow battens are nailed vertically to wall framing and wider boards are nailed over these so that the edges of boards lap battens. A slight space is left between adjacent boards. This pattern is simulated with plywood by cutting wide vertical grooves in the face ply at uniform spacing.

Ridge. The horizontal line at the junction of the top edges of two sloping roof surfaces.

Ridge board. The board placed on edge at the ridge of the roof, into which the upper ends of the rafters are fastened.

Ring shank nail. A nail with ridges forming rings around the shank to provide better withdrawal resistance.

Rise. In stairs, the vertical height of a step or flight of stairs.

Riser. Each of the vertical boards closing the spaces between the treads of stairways.

Rolled roofing. Roofing material composed of fiber and saturated with asphalt, that is supplied in 36-inch-wide rolls with 108 square feet of material. Weights are generally 45 to 90 pounds per roll.

Roof, built-up. See Built-up roof.

Roof, sheathing. The boards or sheet material fastened to the rafters, on which shingles or other roof covering is laid.

Roof, valley. See Valley.

- Rottenstone.** A slightly abrasive stone used to rub a transparent interior finish to achieve a smooth surface.
- Run.** In stairs, the net front-to-back width of a step or the horizontal distance covered by a flight of stairs.
- Saddle.** Two sloping surfaces meeting in a horizontal ridge, used between the back side of a chimney, or other vertical surface, and a sloping roof. Saddles are also called crickets.
- Sapwood.** The outer zone of wood in a tree, next to the bark. In the living tree it contains some living cells (the heartwood contains none), as well as dead and dying cells. In most species, it is lighter colored than the heartwood. In all species, it lacks resistance to decay.
- Sash.** A frame containing one or more lights of glass.
- Saturated felt.** Felt impregnated with tar or asphalt.
- Sawkerf.** *See* Kerf.
- Scab.** A short length of board nailed over the joint of two boards butted end to end to transfer tensile stresses between the two boards.
- Scaling.** Loss of smooth surface of concrete as a result of flaking or scaling.
- Scribing.** Fitting woodwork to an irregular surface. With moldings, scribing means cutting the end of one piece to fit the molded face of the other at an interior angle, in place of a miter joint.
- Scuttle Hole.** An opening in the ceiling to provide access to the attic. It is covered by a closure panel when not in use.
- Sealant.** *See* Caulk.
- Sealer.** A finishing material, either clear or pigmented, that is usually applied directly over uncoated wood to seal the surface.
- Seam, standing.** A joint between two adjacent sheets of metal roofing in which the edges are bent up to prevent leakage and the joint between the raised edges is covered.
- Seasoning.** Removing moisture from green wood to improve its serviceability.
- Semigloss paint or enamel.** A paint or enamel made with a slight insufficiency of nonvolatile vehicle so that its coating, when dry, has some luster but is not very glossy.
- Shake.** A thick handsplit shingle, resawed to form two shakes; usually edge-grained.
- Sheathing.** The covering used over joists, studs, or rafters of a structure.
- Sheathing paper.** A building material, generally paper or felt, used in wall and roof construction as a protection against the passage of air and water.
- Shed dormer.** A dormer that has a roof sloping only one direction at a much shallower slope than the main roof of the house.
- Sheet metal work.** All components of a house employing sheet metal, such as ducts, flashing, gutters, and downspouts.
- Sheetrock.** A term commonly applied to gypsum board.
- Shellac.** A transparent coating made by dissolving lac, a resinous secretion of the lac insect (a scale insect that thrives in tropical countries, especially India), in alcohol.
- Shim.** A thin wedge of wood for driving into crevices to bring parts into alignment.
- Shingles.** Roof covering of asphalt, fiberglass, asbestos, wood, tile, slate, or other material or combinations of materials such as asphalt and felt, cut to stock lengths, widths, and thicknesses.
- Shingles, siding.** Various types of shingles used over sheathing for exterior sidewall covering.
- Shiplap.** *See* Lumber, shiplap.
- Shutter.** A lightweight louvered, flush wood or non-wood frame in the form of a door, located at each side of a window. Some are made to close over the window for protection; others are fastened to the wall for decorative purposes.
- Siding, bevel.** In lap siding, wedge-shaped boards used as horizontal siding in a lapped pattern. Bevel siding varies in butt thickness from $\frac{1}{2}$ to $\frac{3}{4}$ inch and is available in widths up to 12 inches. Normally used over some type of sheathing.
- Siding, drop.** Siding that is usually $\frac{3}{4}$ inch thick and 6 or 8 inches wide, with tongue-and-groove or shiplap edges. Often used as siding without sheathing in secondary buildings.
- Sill.** (1) The lowest member of the frame of a structure, resting on the foundation and supporting the floor joists or the uprights of the wall. (2) The member forming the lower side of an opening such as a door sill or window sill.
- Slab.** A concrete floor poured on the ground.
- Sleeper.** A wood member embedded in or resting directly on concrete, as in a floor, that serves to support and to fasten subfloor or flooring.
- Slip tongue.** A spline used to connect two adjacent boards that have grooves facing each other.
- Smokepipe thimble.** *See* Thimble.
- Soffit.** The underside of an overhanging cornice.
- Soil cover or ground cover.** A light covering of plastic film, roll roofing, or similar material, used over the soil in crawl spaces of buildings to minimize movement of moisture from the soil into the crawl space.
- Soil stack.** A general term for the vertical main of a system of soil, waste, or vent piping.
- Sole or sole plate.** *See* Plate.
- Spackle.** *See* Joint cement.
- Spalling.** Chips or splinters breaking loose from the surface of concrete because of moisture moving through from the reverse side.
- Span.** The distance between structural supports such as walls, columns, piers, beams, girders, and trusses.
- Splash Block.** A small masonry block laid with the top close to the ground surface, to receive roof drainage from downspouts and carry it away from the building.

- Spline.** A long, narrow, thin strip of wood or metal often inserted into the edges of adjacent boards to form a tight joint.
- Square.** A unit of measure usually applied to roofing material, denoting a sufficient quantity to cover 100 square feet of surface.
- Stair carriage.** Supporting member for stair treads. Usually a 2-inch plank notched to receive the treads; sometimes called a “rough horse” or “stringer.”
- Stair landing.** See Landing.
- Stair rise.** See Rise.
- STC (Sound Transmission Class).** A numerical measure of the ability of a material or assembly to resist the passage of sound. Materials with higher STC numbers have greater resistance to sound transmission.
- Stile.** An upright framing member in a panel door.
- Stool.** A flat molding fitted over the window sill between jambs and contacting the bottom rail of the lower sash.
- Stop, trim.** The trim member on the jambs of an opening that a door or window closes against.
- Stop, gravel.** A raised ridge of metal at the edge of a tar and gravel roof that keeps the gravel from falling off the roof.
- Strip flooring.** Wood flooring consisting of narrow, matched strips.
- String or stringer.** A timber or other support for cross members in floors or ceilings. In stairs, the stringer (or stair carriage) supports the stair treads.
- Structural flakeboard.** A panel material made of specially produced flakes that are compressed and bonded together with phenolic resin. Popular types include waferboard and OSB (oriented strand board). Structural flakeboards are used for many of the same applications as plywood.
- Stucco.** A plaster for exterior use, made with Portland cement as its base.
- Stud.** One of a series of slender wood or metal vertical structural members placed as supporting elements in walls and partitions. (Plural = studs or studding.)
- Studwall.** A wall consisting of spaced vertical structural members with thin facing material applied to each side.
- Subfloor.** Boards or plywood laid on joists, over which a finish floor is to be laid.
- Tail beam.** A relatively short beam or joist supported by a wall at one end and by a header at the other.
- Tenon.** A projection at the end of a board, plank, or timber for insertion into a mortise.
- Termite shield.** A shield, usually of noncorrodible metal, placed in or on a foundation wall or other mass of masonry or around pipes, to prevent passage of termites.
- Thimble.** The section of a vitreous clay flue that passes through a wall.
- Threshold.** A strip of wood or metal with beveled edges, used over the finish floor and the sill of exterior doors.
- Tieback member.** A timber, oriented perpendicular to a retaining wall, that ties the wall to a deadman buried behind the wall.
- Toenailing.** Driving a nail at a slant with the initial surface to permit it to penetrate into a second member.
- Tongue and groove.** Boards or planks machined in such a manner that there is a groove on one edge and a corresponding projection (tongue) on the other edge, so that a number of such boards or planks can be fitted together. “Dressed and matched” is an alternative term with the same meaning.
- Tread.** The horizontal board in a stairway on which the foot is placed.
- Trim.** The finish materials in a building, such as molding applied around openings (window trim, door trim) or at the floor and ceiling of rooms (baseboard, cornice, and other moldings).
- Trimmer.** A beam or joist to which a header is nailed in framing a chimney, stairway, or other opening.
- Truss.** A framed or jointed structure, composed of triangular elements, designed to act as a beam of long span, while each member is usually subjected to longitudinal stress only, either tension or compression.
- Truss plate.** A heavy-gauge, pronged metal plate that is pressed into the sides of a wood truss at the point where two more members are to be joined together.
- Undercoat.** A coating applied prior to the finishing or top coats of a paint job. When it is the first of two or more coats, it is synonymous with priming coat.
- Underlayment.** A material placed under flexible flooring materials such as carpet, vinyl tile, or linoleum to provide a smooth base over which to lay such materials.
- Valley.** The internal angle formed by the junction of two sloping sides of a roof.
- Vapor retarder.** Material used to retard the movement of water vapor into walls. Vapor retarders are applied over the warm side of exposed walls or as a part of batt or blanket insulation. They usually have perm value of less than 1.0.
- Varnish.** A thickened preparation of drying oil or drying oil and resin suitable for spreading on surfaces to form continuous, transparent coatings, or for mixing with pigments to make enamels.
- Vehicle.** The liquid portion of a finishing material; it consists of the binder (nonvolatile) and volatile thinners.
- Veneer.** Thin sheets of wood made by rotary cutting or slicing.
- Vent.** A pipe or duct, or a screened or louvered opening, which provides an inlet or outlet for the flow of air. Common types of roof vents include ridge vents, soffit vents, and gable end vents.
- Volatile thinner.** A liquid that evaporates readily, used to thin or reduce the consistency of finishes without altering the relative volumes of pigments and nonvolatile vehicles.

Waferboard. A type of structural flakeboard made of compressed, wafer-like wood particles or flakes bonded together with a phenolic resin. The flakes may vary in size and thickness may be either randomly or directionally oriented.

Wallplate. The cover over an electrical outlet or switch on the wall.

Wane. Bark, or lack of wood from any cause, on the edge or corner, of a piece of wood. Hence, waney.

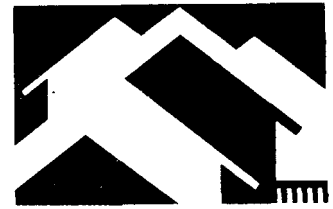
Water-repellent preservative. A liquid designed to penetrate into wood, to impart water resistance and moderate preservative protection. It is used for millwork such as sash and frames, and is usually applied by dipping.

Weatherstripping. Strips of thin metal or other material, that prevent infiltration of air and moisture around windows and doors. Compression weatherstripping on single- and double-hung windows performs the additional function of holding such windows in place in any position.

Web. The thin center portion of a beam that connects the wider top and bottom flanges.

Whaler. A large structural member placed horizontally against foundation forms to which braces are temporarily attached to prevent forms from moving horizontally under the pressure of concrete.

Withe. A vertical layer of bricks, one brick thick.



- All-weather construction, 227-228
- Aluminum foil, 168
- Anchor bolts, 21, 39-40
- Apron, window, 192-194
- Asphalt shingles, 92-94
- Attic folding stairs, 60-61
- Attic inspection:
 - condensation, 229-230
 - ice dams, 229-230
- Attic ventilation, 105-109

- Balustrades, 154
- Basement:
 - drainage, 22-23
 - insulation, 173
 - wood walls, 18-19
- Basement rooms, ceiling height, 18
- Basement stairs, construction, 55-58
- Base molding, 194-195
- Bathtub, double joists for framing, 49
- Batt insulation:
 - placement, 167-170
- Batter boards, 13
- Beams:
 - built-up, 41
 - collar, 78
 - notched, 26
 - solid, 41
- Bevel siding, 117, 120-121
- Bolts, anchor, 21, 39-40
- Boston ridge, 94
- Box cornice, 128-130
- Brick veneer, 26
- Bridging, 47
- Building cost, method of reducing, 51
- Built-up girder, 41
- Built-up roof, 94

- Cabinets, 196-197
- Cant strips, 247
- Carpeting, 187
- Carport, 152
- Casement-sash windows, 113
- Casing, 192
- Caulking, 230

- Ceiling framing, 72-82
- Ceiling molding, 195-196
- Cement-coated nails, 128
- Ceramic tile:
 - floor installation, 187
 - wall installation, 180
- Chimney:
 - flashing, 102-103, 148
 - flue installation, 147-150
 - height, 148
- Closed cornice, 132-133
- Closet shelving, 197
- Codes, building, 2-3
- Collar beams, 78
- Columns, 153-154
- Concrete block walls.
 - See Foundation walls.
- Concrete forms, 20
- Concrete slabs:
 - construction, 23, 29-30, 181
 - insulation, 30-32
 - vapor retarder, 30, 32, 181
- Concrete work, cold weather, 17, 227
- Condensation, 231
- Construction costs, 3-4
- Corner boards, 123
- Corner intersections, details, 122-123
- Cornice returns, 129, 134-135
- Cornice, types:
 - box, 128-130
 - closed, 132-133
 - open, 132
- Counterflashing, at chimneys, 102-103
- Cove, 195-196
- Crawl space:
 - soil cover, 23-25, 28-29
 - ventilation, 23-25, 28-29
- Decay protection:
 - attic ventilation, 105-109
 - construction details, 210-215
 - crawl space ventilation, 28-29
 - soil cover, 28-29
 - treated wood, 214-215
- Decay resistance, 210

- Decks, 154-160
- Dehumidifiers, 229
- Diagonals, as check for
 - square corners, 241-242
- Dimension lumber, 237-238
- Door frames, exterior, 115
- Door frames, interior, 187-188
- Door headers, size, spacing, 64-65
- Doors, exterior:
 - framing, sizes, types, 115, 152
- Doors, interior, 187-188
- Dormers, 80
- Double-hung windows, 112-113
- Downspout, 103-105
- Drainage, 22-23
- Drain tile, 22-23
- Driveways, 160-162
- Drywall. See Gypsum board.
- Dry-wood termites. See Termites.

- Electrical outlets, moisture control, 172
- Enamel, types, use, 197-198
- Energy conservation, 6-7, 214-221
- Excavation, 13
- Exposed beams, 128
- Exterior stairs, 61
- Exterior trim, 127-135

- Fascia board, 128, 133
- Fiberboard sheathing, 69-70, 86-87
- Finishes:
 - exterior, 200-208
 - interior, 175-180, 197-200
- Fireplace, 144-145, 197
- Fire protection:
 - fire-rated gypsum board, 175
 - garage walls, 151-152
- Flashing, 100-105
- Flat paint, 197
- Flat roofs:
 - construction, 81-82, 100
 - ventilation required, 108-109

- Floor coverings:
 - carpeting, 187
 - ceramic tile, 187
 - resilient sheets, 187
 - resilient tile, 187
 - wood parquet, 182-187
 - wood strip, 183-184
- Floor framing:
 - design factors, 38-39
 - girders, 39-41
 - notched for pipes, 49
 - posts, 39-40
 - quality, 38
- Flooring:
 - care of after delivery, 6-8
 - cause of open joints, 231
 - method of nailing first strips, 183
 - moisture content recommended, 38
 - nails, 183-184
 - parquet, 182-187
 - strip, 183-184
- Floor joists. *See* Joists.
- Floor slabs. *See* Concrete slab floors.
- Flue lining, 149
- Flush doors, 115
- Fly rafter, 133
- Footings, 13-16
- Formwork for concrete walls, 20
- Foundation:
 - concrete, 19-20, 23, 29-32
 - drainage, 22-23
 - excavation, 13
 - masonry, 20-22, 25
 - sill anchors, 25-26
 - wood, 18-19, 23-24
- Framing for:
 - ceiling, 72-82
 - chimneys, 147-150
 - dormers, 80
 - fireplaces, 144-145
 - floor joists, 47-50
 - floor openings, 47-48
 - floors, 38-50
 - overhangs, 48-49, 78
 - plumbing, 49-50, 166-167
 - roofs, 72-82
 - stairwells, 54
 - valleys, 79
 - walls, 62-65, 166
 - windows, 64-65
- Framing lumber, 38
- Frieze board, 249
- Fungi, decay, 210
- Gable roofs, 73-78
- Galley kitchen layout, 197
- Galvanized metal flashing, 100
- Gambrel roof, 73, 249
- Garages, 151-152
- Girders:
 - built-up, 41
 - solid, 39-40
 - steel, 41
- Grades, sloped for drainage, 18
- Gutters, 103-104
- Gypsum board:
 - finishing operation, 175-176
 - installation, 175-176
 - joints, cementing and taping of, 176
 - types, 175
- Gypsum sheathing, 70
- Hardwood flooring, 180-181
- Headers:
 - door, 64-65
 - joists, 45
 - stair, 57
 - window, 64-65
- Heartwood, decay resistance, 210
- Hip roof, 75-76, 79, 108
- Horizontal sheathing, 71-72
- Horizontal sliding window, 115
- I-beam, 41
- Ice dams, 88, 229-230
- Impact noise rating, 222-223
- Insulating board sheathing, 69-70
- Insulation:
 - batts, 167, 170
 - blankets, 167-173
 - for concrete slabs, 30-32
 - installation, 167-173
 - loose fill, 171
 - rigid foam, 70-71
 - thermal properties, 235-236
 - types, 167-168
 - U-value, 236
- Interior doors, 187-188
- Interior finish, types, 175-180
- Interior paints and stains, 197-200
- Interior trim, 192-196
- Jack rafters, 250
- Jambs, 115
- Joists:
 - doubled as bathtub supports, 49
 - doubled under bearing walls, 45
 - drilled for pipes, 49-50
 - installation, 41-50, 78
 - notched for pipes, 49
 - sizes, spans, 42
 - spaced for ducts, 50
- Kitchen cabinets, arrangements, sizes, 196-197
- Ledgerstrips, use with girders, 42
- Lintels: doors, windows, 64-65
- Lookouts:
 - cornice, 129-130
 - overhanging, 133-134
- Loose-fill insulation, 171
- Louvers, 107
- L-type kitchen layout, 197
- Lumber, storage, 7
- Maintenance:
 - attic, 229-230
 - basement, 228-229
 - crawl space, 229
 - doors, 231
 - flooring, 231
 - gypsum board, 230
 - unheated rooms, 231
 - walls, exterior, 208, 230
- Mansard roofs, 73
- Mantel, 197
- Masonry foundation:
 - piers, 25
 - Walls, 20-22, 25
- Masonry veneer, 26, 126
- Metal ridge roll, 100
- Millwork, 196-197
- Moisture condensation:
 - prevention on doors and windows, 231
 - vapor retarders, 173-175
 - ventilation, 105-109
- Moisture-excluding
 - effectiveness of coatings, 201-207
- Mold fungi, as decay warning, 210
- Moldings:
 - base, 194-195
 - ceiling, 195-196
 - crown, 196
- Muntins, 113, 251

- Nailing methods for:
 - asphalt shingles, 94
 - bevel siding, 120
 - ceiling framing, 76
 - fiberboard sheathing, 70, 72
 - fiberglass shingles, 94
 - fireplace framing, 144
 - gypsum sheathing, 72
 - headers, 45
 - jack rafters, 79
 - rafters, 78
 - roof framing, 76
 - roof sheathing, 84-87
 - subfloor, 61-62, 181-182
 - wall sheathing, 71-72
 - wood shingles, 90-91, 124-125
- Nailing strips, for sheathing and shingles, 85, 94
- Nails:
 - annularly threaded shank, 5, 119
 - corrosion-resistant, 5, 119
 - finish flooring, 5, 119
 - helically threaded, 5, 119
 - ring-shank, 5, 119
 - rust-resistant, 5, 119
 - siding, 119-120
 - steel, as cause of rust spots, 119
- Natural finishes:
 - for siding and trim, 116, 198-199
 - types, 198-199, 205
 - wood species preferred for, 116, 198-199
- Newel post, 58
- Open cornice, construction, 132
- Paint:
 - exterior, 200-208
 - interior, 197-198
- Paintability of various woods, 200-202
- Painting:
 - characteristics of wood for, 200-202
 - interior walls, 197-198
 - primer coats, 206
 - rate of coverage, 206
 - siding and trim, 205-206
 - treated wood, 207
- Paints:
 - enamels, 197-198
 - moisture-excluding effectiveness, 201-207
 - natural finishes, 198-200, 205
 - semigloss enamel, 197
 - varnish, 199-200, 205
 - wood sealers, 199-200
- Panel doors, 115, 152
- Piers:
 - masonry, 25
 - poured concrete, 15-16
- Pitched roofs:
 - gable, 73-78
 - hip, 75-76, 79, 108
 - materials for covering, 87-94
- Planning:
 - energy conservation, 6-7
 - financial, 3-4
 - house design, 4-5
 - material efficiency, 6
 - protection of materials, 7-8
 - schedule of activities, 8-9
 - site selection, 4
 - subcontracting, 8
- Platform construction, 62-64
- Plumbing, framing for, 49-50, 166-167
- Plywood:
 - paneling, 176
 - roof sheathing, 83-84
 - siding, 117, 122, 202
 - subfloor, 61-62, 181-182
 - wall sheathing, 66, 71
- Polystyrene sheathing, See Insulation.
- Porches:
 - columns for, 153-154
 - construction principles, 152-154
 - framing for, 153
- Posts:
 - girder supports, 39-41
 - steel pipe, 39, 40
 - wood, 40
- Poured concrete walls, 19-20, 26, 36
- Preservative treatment:
 - before painting, 205-206
 - decay, methods, specification, 210-215
 - termites, methods, specification, 210-214
 - with natural finishes, 198-199
- Protection of materials, 7-8
- Rafters:
 - flat roof, 81-82
 - Jack, 78-79, 250
 - overhanging roof, 78, 82, 128-129
- Rainwater back of siding,
 - remedy for, 230
- Rake, 133-134
- Random-width plank flooring, 184
- Regulations, 2-3
- Reinforcing rods for concrete walls, 26, 35-36
- Ridge board See Roofs.
- Ridge flashing, use on wood-shingled houses, 100
- Rigid insulation,
 - application, 70-71, 167-168
- Riser, ratio to tread, 52-53
- Rods, reinforcing in concrete walls, 25, 35-36
- Roofs:
 - Boston ridge for, 94
 - built-up, 94
 - covering materials, 87-94
 - dormers for, 80
 - flashing for, 100-105
 - flat, 81-82, 100, 108-109
 - framing for, 72-82
 - gable, 73-78
 - hip, 75-76, 79, 108
 - leaking, causes, 229-230
 - maintenance inspection, 229-230
 - metal ridge for, 100
 - overhang, 78, 82, 128-129, 133
 - sheathing for, 83-87
 - trusses for, 73-78
 - types of, 72-73
 - valleys, 101-102
 - ventilation of, 105-109
- Roof trusses. See Trusses.
- Rust-resistant nails, 128
- Rust on siding, cause and remedy, 119-120
- Saddle flashing, 103
- Sapwood:
 - decay resistance, 210
- Sealer, 199-200
- Seasoning of framing lumber See wall framing.
- Seismic load, 225-226
- Setback, minimum required, 12
- Shakes, wood, 88-92, 117-119, 124-125
- Sheathing, roof:
 - chimneys, 87
 - planking decking, 86-87
 - plywood, 83-84
 - structural flakeboard, 84
 - wood, boards, 84-85
- Sheathing, wall:
 - fiberboard, 69-70, 72
 - gypsum board, 70, 72
 - plywood, 66, 71
 - structural flakeboard, 66-68, 71
 - wood, 68, 72

- Sheet-metal work, types, weights of materials, 100
- Shingles:
 - asphalt, 88, 92-94
 - fiberglass, 92-94
 - wood, 88-92, 117-119, 124-125
- Sidewalk construction, 162-163
- Sidewall kitchen layout, 197
- Siding:
 - aluminum, 126-127
 - corner treatment, 122-123
 - installation, 119-127
 - nailing, 5, 119-120
 - sheet materials, 117
 - storage, 7
 - types, 116-119
 - wood, 116
- Sill anchors, 25-26
- Sill plate, 25-26, 39
- Sills, 115
- Site selection, 4
- Skylights, 94-96
- Snow dams, protection from, 224-225
- Soffit, 128-129
- Soil cover, 23-25, 28-29, 229
- Sound absorption, 221-222
- Sound transmission class ratings, 222-223
- Splash block, 105
- Stack vent, framing for, 49-50, 166-167
- Stairs:
 - attic folding, 60-61
 - basement, construction, 55-58
 - carriages, 52, 55-58
 - exterior, construction, 61
 - ratio of riser to tread, 52-53
- Stairways:
 - design, installation, 50-61
- Stationary windows, 113-114
- Stiles, 254
- Stops, interior door frames, 187
- Storm sash, 231
- Stringer, installation in stairways, 52, 55-58
- Strip flooring installation, 183-184
- Stucco side-wall finish, 125
- Studs:
 - end-wall, 63-64
 - grades of, 62
 - species, 62
- Subfloor:
 - boards, 62
 - plywood, 61-62, 181-182
 - structural flakeboard, 62
- Subterranean termites, 210-211
- Temperature, requirements during construction, 227-228
- Termites:
 - classes, 210
 - dry-wood, where common, 210-212
 - inspection of crawl spaces for, 229
 - protection from, 26-28, 31, 210-212, 214
 - subterranean, 210-212
- Thermal properties, building materials, 235-236
- Ties, reinforcing, 26
- Tile floor, ceramic, installation, 187
- Trim:
 - exterior:
 - decay resistance, 127
 - fastenings, 128
 - interior:
 - installation, 192-196
 - window installation, 192-194
- Trusses:
 - anchoring, 76-78
 - bracing, 76-78
 - Fink, 75, 130
 - floor, 76
 - gable, 75
 - handling, 76
 - hip, 75-76, 79
 - Howe, 75
 - king-post, 75
 - scissors, 75
- Unheated rooms, maintenance, ventilation, 231
- U-type kitchen layout, 196
- Valley:
 - flashing, 101-102
 - framing, 79
- Vapor retarders:
 - effective materials for, 173-175
 - in blanket insulation, 171-172
 - in concrete-slab floor, 30, 32, 181
 - polyethylene, 172-174
- Varnish, 199-200
- Ventilation:
 - attic, 105-109
 - cold-weather, need for, 230
 - crawl spaces, area and vents required, 23-25, 28-29
 - ice dams reduced by, 88
 - moisture removed by, 174
 - unheated rooms, 231
- Ventilators, location, types, 106-109
- Vertical siding, types, use, 117, 121-122
- Wainscot, 179-180
- wall coverings:
 - exterior:
 - aluminum, 126-127
 - brick, 126
 - siding, 116-119
 - stucco, 125
 - interior:
 - gypsum board, 175-176
 - paneling, 176-180
- Wall footings, 14-15
- Wall framing, 62-65, 166
- Wall sheathing, 65-72
- Walls, concrete block, 20-22, 35-36
- Walls, poured concrete, 19-20, 36
- Water-repellent preservative, for siding, 117, 205, 207-208
- Water vapor:
 - damage caused by, 212-213
 - generation, 212-213
- Weatherstripping, 231
- Weep holes, for brick veneer, 26
- Window:
 - headers, sizes, spacing, 64-65
 - Stool, 192-194
 - trim, installation, 192-194
- Windows:
 - awning, 115
 - casement, 113
 - double-hung, 112-113
 - horizontal sliding, 115
 - insulated glass, 110
 - stationary, 109-115
 - types of, 109-115
 - weatherstripping for, 231
- Wiring, electrical, installation, 50, 166-167
- Woods, decay resistance of, 210
- Woods, painting characteristics, 200-202